WE CLAIM:

1. A method for tracking a particle through a geometric model, the steps comprising:

arranging a plurality of substantially uniform volume elements into said geometric model;

describing a movement of said particle through said geometric model with a particle track; and

traversing said particle along said particle track from one said uniform volume element to another said uniform volume element in integer based increments.

2. A method according to claim 1, further comprising the step of converting a plurality of pixels of information contained in a medical image into said uniform volume elements.

3. A method according to claim 1, further comprising the step of defining a material to be associated with each said uniform volume element.

4. A method according to claim 3, further comprising the step of mapping each said material to an array.

5. A method according to claim 1, further comprising the steps of:

determining a material of both said one and said another said uniform volume elements; and

terminating said step of traversing said particle when said material of said another said uniform volume element is substantially different from said material of said one said uniform volume element.

6. A method according to claim 5, further comprising the step of determining a position of intersection along said particle track where said material of said one said uniform volume element changed into said material of said another said uniform volume element.

7. A method according to claim 6, further comprising the step of reporting said position of intersection.

8. A method according to claim 1, wherein said particle track has a primary direction of movement, further comprising the step of traversing said particle along said particle track along said primary direction of movement.

9. A method according to claim 1, further comprising the step of setting an initial condition for said particle track.

10. A method according to claim 9, wherein said particle traverses along said particle track beginning in a starting element of said uniform volume elements and traverses to a next element of said uniform volume elements, further comprising the step of determining a center value of said starting element along a primary direction of movement for said particle track, said center value representing at least a portion of an adjusted coordinate from which said particle will begin traversal along said particle track.

11. A method according to claim 10, wherein said particle track has at least one secondary direction of movement, further comprising the step of determining a beginning coordinate value for each said secondary direction of movement in response to said step of

determining said center value of said starting element along said primary direction of movement.

12. A method according to claim 1, wherein said particle track has at least one secondary direction of movement, further comprising the step of calculating an error term for each said secondary direction of movement, said error terms being used to adjust a coordinate value whenever said error term exceeds a threshold value.

13. A method for simulating particle transport through a geometric model, the steps comprising:

arranging a plurality of substantially uniform volume elements into said geometric model;

defining a material to be associated with each said uniform volume element, at least one of said uniform volume elements corresponding to a radiation source;

describing a particle track with a primary direction of movement through said geometric model, said particle track beginning substantially internally within said geometric model at said one of said uniform volume elements corresponding to said radiation source in a starting element of said uniform volume elements and traversing to a next element of said uniform volume elements; and

following a particle along said particle track through said geometric model until said material of said next element is substantially different from said material of said starting element.

14. A method according to claim 13, wherein said step of describing said particle track comprises the steps of defining an initial position and a vector for said particle.

15. A method according to claim 13, wherein said step of defining said material to be associated with each said uniform volume element further comprises the step of mapping each said material to an array.

16. A method according to claim 13, wherein said step of following said particle along said particle track comprises the step of stepping along said particle track in integer based increments of said coordinate system along said primary direction of movement.

17. A method of computationally enlarging a radiation distribution for a treatment volume irradiated during radiation therapy having a radiation source substantially internal within a patient, the steps comprising:

obtaining a medical image of said treatment volume, said medical image containing a plurality of pixels of information;

converting said pixels into a plurality of substantially uniform volume elements;

arranging said uniform volume elements into a geometric model;

defining a material to be associated with each said uniform volume element, at least one of said uniform volume elements corresponding to said radiation source;

describing a plurality of particle tracks through said geometric model, said particle tracks beginning substantially internally within said geometric model at said one of said uniform volume elements corresponding to said radiation source having a primary direction of movement beginning in a starting element of said uniform volume elements and traversing to a next element of said uniform volume elements;

simulating a particle movement along each said particle track through said geometric model in integer based increments along said primary direction of movement until a position when said material of said next element is substantially different from

said material of said starting element, said particle corresponding to an alpha, beta or gamma emission emanating from said radiation source during said radiation therapy, said position corresponding to at least one of said particle being captured, scattered and exited from said geometric model; and

computing a distribution of radiation doses based upon said particle movement along each said particle track.

18. A method according to claim 17, further comprising the step of generating a plurality of axial slices of said treatment volume.

19. A method according to claim 17, wherein said step of converting said pixels into said uniform volume elements further comprises the step of proportionally converting a volume and shape of said pixels into a corresponding volume and shape of said uniform volume elements.

20. A computer readable medium having computer executable instructions for tracking a movement of a particle through a geometric model, the computer executable instructions for performing the steps of:

arranging a plurality of substantially uniform volume elements into said geometric model;

mapping a material associated with each said uniform volume element to an array, at least one of said uniform volume elements being mapped to a radiation source;

projecting said movement of said particle through said geometric model with a particle track beginning in a starting element of said uniform volume elements and traversing to a next element of said uniform volume elements; and

traversing said particle along said particle track in integer based increments until said material of said next element is substantially different from said material of said starting element.

21. A computer readable medium according to claim 20, further comprising computer executable instructions for performing the step of storing said array in a storage device.

22. A computer readable medium according to claim 20, further comprising computer executable instructions for performing the step of establishing a center value for said particle track along a primary direction of movement thereof.

23. A computer readable medium according to claim 20, further comprising computer executable instructions for performing the step of storing said array by integers determined from a selected coordinate system.

24. A computer readable medium according to claim 23, further comprising computer executable instructions for performing the step of computing error terms to be

associated with at least one secondary direction of movement, said error terms being used to properly identify said materials stored in said array.

25. A computer readable medium according to claim 20, further comprising computer executable instructions for performing the steps of:

reading a medical image of a treatment volume irradiated by said radiation source having a plurality of pixels of information contained therein; and

converting said pixels into said uniform volume elements.

26. A computer readable medium according to claim 25, further comprising computer executable instructions for performing the step of proportionally converting a volume and shape of said pixels into a corresponding volume and shape of said uniform volume elements.

27. A computer readable medium according to claim 25, wherein said medical image comprises a plurality of substantially cross-sectional slices of said treatment volume, further comprising computer executable instructions for performing the step of stacking said uniform volume elements into a three dimensional representation of said treatment volume.

28. A computer readable medium according to claim 20, further comprising computer executable instructions for performing the step of displaying said geometric model.

29. A computer readable medium having computer executable instructions for computationally enlarging a radiation distribution of a treatment volume irradiated during a radiation therapy having a radiation source, said computer executable instructions for performing the steps of:

reading a medical image of said treatment volume, said medical image containing a plurality of pixels of information;

converting said pixels into a plurality of substantially uniform volume elements;

mathematically arranging said uniform volume elements into a geometric model substantially representing said treatment volume;

mapping a material associated with each said uniform volume element to an array, at least one of said uniform volume elements corresponding to said radiation source;

describing a plurality of particle tracks through said geometric model, said particle tracks beginning substantially internally within said geometric model in a starting element of said uniform volume elements and traversing to a next element of said uniform volume elements;

simulating a particle movement along each said particle track through said geometric model in integer based increments until a position when said material of said next element is substantially different from said material of said starting element, said

particle corresponding to an alpha, beta or gamma emission emanating from said radiation source during said radiation therapy, said position corresponding to at least one of said particle being captured, scattered and exited from said geometric model; and

computing a distribution of radiation doses based upon said particle movement along each said particle track.

30. A computer readable medium having computer executable modules for enlarging a radiation distribution of a treatment volume irradiated during a radiation therapy having a radiation source, comprising:

a reader module for converting a plurality of pixels of information contained in a medical image into a corresponding plurality of uniform volume elements;

a modeling module for arranging said uniform volume elements into a geometric representation of said treatment volume;

a storage module for storing a material for each said uniform volume elements, at least one of said uniform volume elements being stored as corresponding to said radiation source;

a projection module for tracking a movement of a particle through said geometric representation according to integer based steps; and

a random generation module for calculating a status of said particle as said movement of said particle is tracked through said geometric representation.

31. A method for enlarging a radiation distribution of a treatment volume irradiated during a radiation therapy having a radiation source, the steps comprising:

creating a geometric model of said treatment volume;

describing a movement having a primary direction thereof of a particle through said geometric model in integer based increments along said primary direction, said particle representing an alpha, beta or gamma emission emanating from said radiation source during said radiation therapy; and

computing a distribution of radiation doses based upon said movement of said particle.

32. A method according to claim 31, wherein said geometric model is comprised of a plurality of substantially uniform volume elements, further comprising the step of defining a material to be associated with each said uniform volume element, at least one of said uniform volume elements corresponding to said radiation source.

33. A method according to claim 32, wherein said movement begins substantially internally within said geometric model in a starting element of said uniform volume elements and traverses to a next element of said uniform volume elements, further comprising the step of describing said movement of said particle through said geometric model until said material of said next element is substantially different from said material of said starting element.

34. A method according to claim 33, further comprising the step of determining a position where along said movement said next element is substantially different from said material of said starting element.

35. A computer readable medium having computer executable instructions for performing the steps as recited in claim 31.

36. A method for simulating particle transport through a geometric model, the steps comprising:

arranging a plurality of substantially uniform volume elements into said geometric model;

defining a material to be associated with each said uniform volume element, at least one of said uniform volume elements corresponding to a radiation source;

describing a particle track with a primary direction of movement through said geometric model, said particle track beginning within that surface uniform volume element first encountered by a particle from an externally-applied radiation source and proceeding therefrom as if said particle track were born within said first surface uniform volume element; and

following a particle along said particle track through said geometric model until said material of said next element is substantially different from said material of said starting element.

37. A method according to claim 36, wherein said step of describing said particle track comprises the steps of defining an initial position and a vector for said particle.

38. A method according to claim 36, wherein said step of defining said material to be associated with each said uniform volume element further comprises the step of mapping each said material to an array.

39. A method according to claim 36, wherein said step of following said particle along said particle track comprises the step of stepping along said particle track in integer based increments of said coordinate system along said primary direction of movement.

40. A method of computationally enlarging a radiation distribution for a treatment volume irradiated during radiation therapy having a radiation source external to a patient, the steps comprising:

obtaining a medical image of said treatment volume, said medical image containing a plurality of pixels of information;

converting said pixels into a plurality of substantially uniform volume elements;

arranging said uniform volume elements into a geometric model;

defining a material to be associated with each said uniform volume element, at least one of said uniform volume elements corresponding to said radiation source;

describing a plurality of particle tracks through said geometric model, said plurality of particle tracks beginning within that surface uniform volume element first encountered by particles from an externally-applied radiation source and proceeding therefrom as if said plurality of particle tracks were born within said first surface uniform volume element; and

simulating a particle movement along each said particle track through said geometric model in integer based increments along said primary direction of movement until a position when said material of said next element is substantially different from said material of said starting element, said particle corresponding to an alpha, beta or gamma emission emanating from said radiation source during said radiation therapy, said position corresponding to at least one of said particle being captured, scattered and exited from said geometric model; and

computing a distribution of radiation doses based upon said particle movement along each said particle track.

41. A method according to claim 40, further comprising the step of generating a plurality of axial slices of said treatment volume.

42. A method according to claim 40, wherein said step of converting said pixels into said uniform volume elements further comprises the step of proportionally converting a volume and shape of said pixels into a corresponding volume and shape of said uniform volume elements.

43. A computer readable medium having computer executable instructions for computationally enlarging a radiation distribution of a treatment volume irradiated during a radiation therapy having a radiation source, said computer executable instructions for performing the steps of:

reading a medical image of said treatment volume, said medical image containing a plurality of pixels of information;

converting said pixels into a plurality of substantially uniform volume elements;

mathematically arranging said uniform volume elements into a geometric model substantially representing said treatment volume;

mapping a material associated with each said uniform volume element to an array, at least one of said uniform volume elements corresponding to said radiation source;

describing a plurality of particle tracks through said geometric model, said plurality of particle tracks beginning within that surface uniform volume element first encountered by particles from an externally-applied radiation source and proceeding therefrom as if said plurality of particle tracks were born within said first surface uniform volume element; and

simulating a particle movement along each said particle track through said geometric model in integer based increments until a position when said material of said next element is substantially different from said material of said starting element, said particle corresponding to an alpha, beta or gamma emission emanating from said radiation source during said radiation therapy, said position corresponding to at least one of said particle being captured, scattered and exited from said geometric model; and

computing a distribution of radiation doses based upon said particle movement along each said particle track.